

Strand 5: Structure and Logic

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

Concept 1: Algorithms and Algorithmic Thinking Use reasoning to solve mathematical problems in contextual situations.									
Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	High School
	PO 1. Create problems based on contextual situations (addition facts up to 18 and subtraction from 9).	PO 1. Create contextual problems that require addition or subtraction with one or two-digit numbers.	PO 1. Discriminate necessary information from unnecessary information in a given grade-level appropriate word problem.	PO 1. Discriminate necessary information from unnecessary information in a given grade-level appropriate word problem.	PO 1. Discriminate necessary information from unnecessary information in a given grade-level appropriate word problem.	PO 1. Discriminate necessary information from unnecessary information in a given grade-level appropriate word problem.	PO 1. Discriminate necessary information from unnecessary information in a given grade-level appropriate word problem.		
								PO 1. Describe how to use a proportion to solve a problem in context.	PO 1. Determine whether a given procedure for simplifying an expression is valid.
					PO 2. Design simple algorithms using whole numbers.	PO 2. Analyze algorithms for computing with decimals.	PO 2. Analyze algorithms for computing with fractions.	PO 2. Analyze algorithms.	PO 2. Determine whether a given procedure for solving an equation is valid.

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				PO 2. Develop an algorithm to calculate perimeter of simple polygons.	PO 3. Develop an algorithm or formula to calculate areas of simple polygons.				PO 3. Determine whether a given procedure for solving a linear inequality is valid.
									PO 4. Select an algorithm that explains a particular mathematical process.
									PO 5. Determine the purpose of a simple mathematical algorithm.
									PO 6. Determine whether given simple mathematical algorithms are equivalent.

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Concept 2: Logic, Reasoning, Arguments, and Mathematical Proof

Evaluate situations, select problem-solving strategies, draw logical conclusions, develop and describe solutions and recognize their applications.

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	High School
PO 1. Sort objects according to observable attributes.	PO 1. List the quantitative components found in word problems.	PO 1. Identify the concepts <i>some</i> , <i>every</i> and <i>many</i> within the context of logical reasoning.	PO 1. Draw conclusions based on existing information (e.g., All students in Ms. Dean's 1st grade class are less than 7 years old. Rafael is in Ms. Dean's class. Conclusion: Rafael is less than 7 years old.).	PO 1. Draw a conclusion from a Venn diagram.	PO 1. Construct <i>if...then</i> statements.	PO 1. Solve a simple logic problem from given information (Which of three different people live in which of three different colored houses?).	PO 1. Solve a logic problem using multiple variables.	PO 1. Solve a logic problem given the necessary information.	PO 1. Draw a simple valid conclusion from a given <i>if...then</i> statement and a minor premise.
PO 2. Provide rationale for classifying objects according to observable attributes (color, size, shape, weight, etc.).	PO 2. Provide rationale for classifying objects according to observable attributes (color, size, shape, weight, etc.).	PO 2. Identify the concepts <i>all</i> and <i>none</i> within the context of logical reasoning.		PO 2. Identify simple valid arguments using <i>if...then</i> statements based on graphic organizers (e.g., 2-set Venn diagrams and pictures).	PO 2. Identify simple valid arguments using <i>if...then</i> statements based on graphic organizers (e.g., 3-set Venn diagrams and pictures).				PO 2. List related <i>if...then</i> statements in logical order.

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Concept 2: Logic, Reasoning, Arguments, and Mathematical Proof Evaluate situations, select problem-solving strategies, draw logical conclusions, develop and describe solutions and recognize their applications.									
Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	High School
									PO 3. Write an appropriate conjecture given a certain set of circumstances.
									PO 4. Analyze assertions related to a contextual situation by using principles of logic.
								PO 2. Identify simple valid arguments using <i>if...then</i> statements (e.g., All squares are rectangles. If quadrilateral ABCD is a rectangle, is it a square?).	PO 5. Identify a valid conjecture using inductive reasoning.

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Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	High School
								PO 3. Model a contextual situation using a flow chart.	PO 6. Distinguish valid arguments from invalid arguments.
									PO 7. Create inductive and deductive arguments concerning geometric ideas and relationships, such as congruence, similarity, and the Pythagorean relationship.
									PO 8. Critique inductive and deductive arguments concerning geometric ideas and relationships, such as congruence, similarity, and the Pythagorean relationship.

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									PO 9. Identify a counterexample for a given conjecture.
									PO 10. Construct a counterexample to show that a given conjecture is false.
									PO 11. State the inverse, converse, or contrapositive of a given statement.
									PO 12. Determine if the inverse, converse, or contrapositive of a given statement is true or false.

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Concept 2: Logic, Reasoning, Arguments, and Mathematical Proof Evaluate situations, select problem-solving strategies, draw logical conclusions, develop and describe solutions and recognize their applications.									
Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	High School
									PO 13. Construct a simple formal or informal deductive proof.
								PO 4. Verify the Pythagorean theorem using an area dissection argument.	PO 14. Verify characteristics of a given geometric figure using coordinate formulas such as distance, mid-point, and slope to confirm parallelism, perpendicularity, and congruency .